SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ECT221 – MICROPROCESSORS AND MICROCONTROLLERS

II YEAR - IV SEM

UNIT 4– INTERFACING MICROCONTROLLER

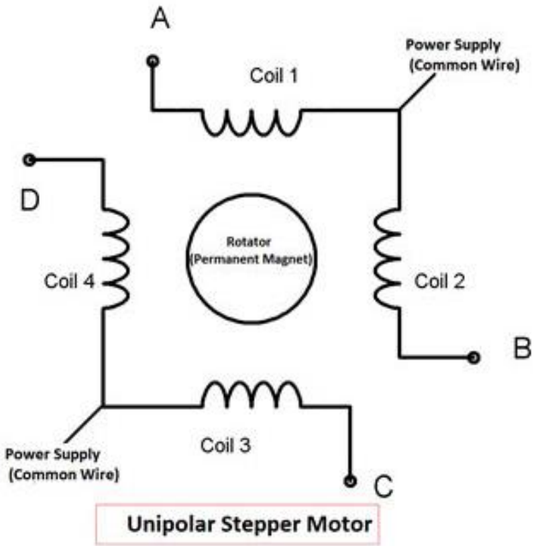
Topic-Stepper Motor and Waveform generation

Stepper Motor

- Stepper motor is brushless DC motor, which can be rotated in small angles, these angles are called steps.
- Generally stepper motor use 200 steps to complete 360 degree rotation, means its rotate 1.8 degree per step.
- Stepper motor used in many devices which needs precise rotational movement like robots, antennas, hard drives etc.
- We can rotate stepper motor to any particular angle by giving it proper instructions.

Stepper Motor

- **Stepper motors** are basically two types: Unipolar and Bipolar.
- **Unipolar stepper** motor generally has five or six wire, in which four wires are one end of four stator coils, and other end of the all four coils is tied together which represents fifth wire, this is called common wire (common point).
- Generally there are two common wire, formed by connecting one end of the two-two coils .
- Unipolar stepper motor is very common and popular because of its ease of use.



Unipolar Stepper Motor

Wave drive Mode

Wave drive mode: In this mode one coil is energised at a time, all four coil are energised one after another. It produces less torque in compare with Full step drive mode but power consumption is less. Following is the table for producing this mode using microcontroller, means we need to give Logic 1 to the coils in the sequential manner.

Steps	A	B	C	D
1	1	0	0	0
2	0	1	0	0
3	0	0	1	0
4	0	0	0	1

Full drive mode

Full Drive mode: In this, two coil are energised at the same time producing high torque. Power consumption is higher.

We need to give Logic 1 to two coils at the same time, then to the next two coils and so on.

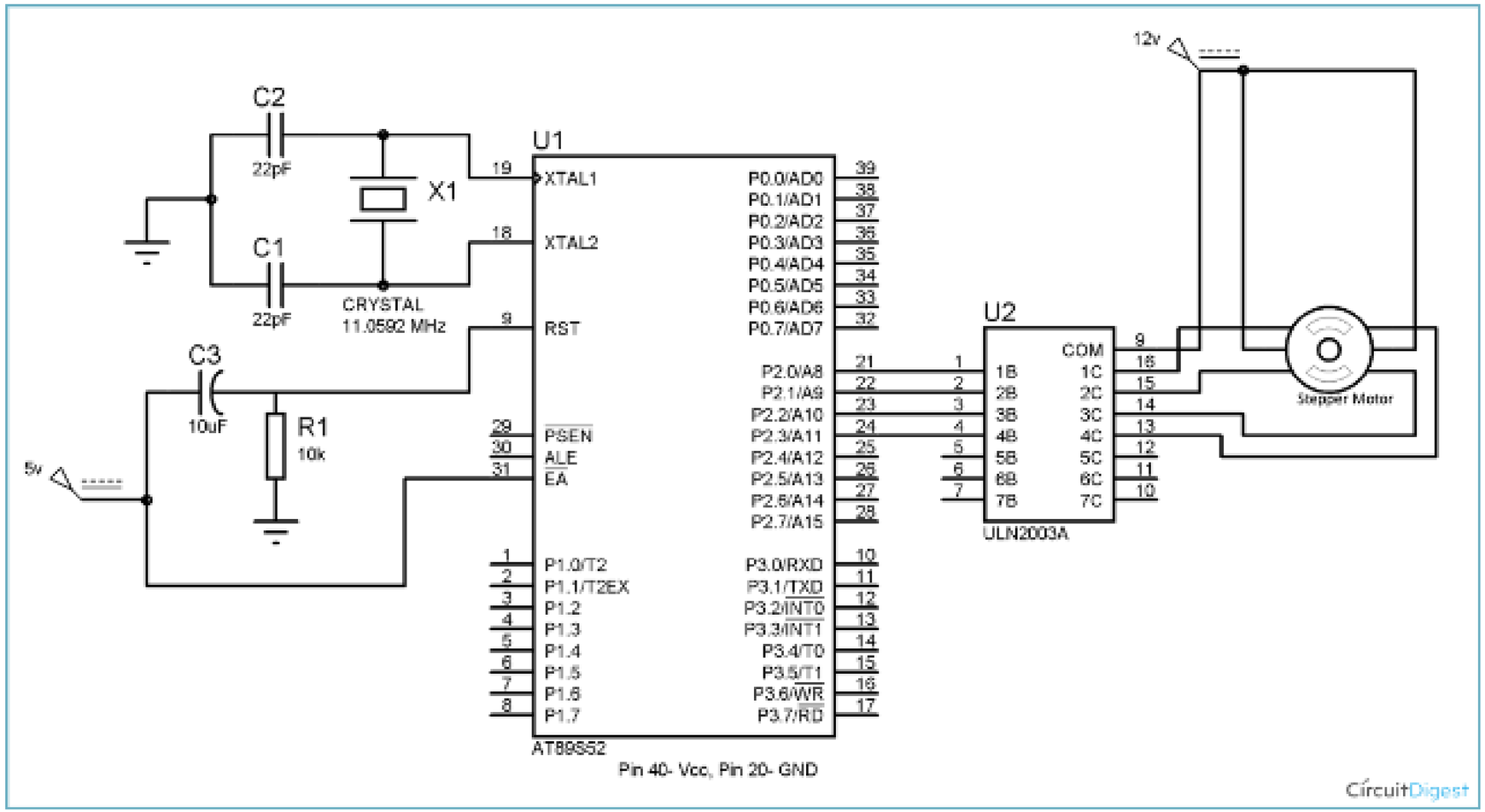
Steps	A	B	C	D
1	1	1	0	0
2	0	1	1	0
3	0	0	1	1
4	1	0	0	1

Half drive Mode

Half Drive mode: In this mode one and two coils are energised alternatively, means firstly one coil is energised then two coils are energised then again one coil is energised then again two, and so on. This is combination of full and wave drive mode, and used to increase the angular rotation of the motor.

Steps	A	B	C	D
1	1	0	0	0
2	1	1	0	0
3	0	1	0	0
4	0	1	1	0
5	0	0	1	0
6	0	0	1	1
7	0	0	0	1
8	1	0	0	1

Interfacing Stepper Motor with 8051 MC



Programmable Timer Interrupt

- Interfacing with 8051 is very easy we just need to give the 0 and 1 to the four wires of stepper motor according to the above tables depending on which mode we want to run the stepper motor.
- And rest two wires should be connected to a proper 12v supply (depending on the stepper motor).
- Here we have used the unipolar stepper motor.
- We have connected four ends of the coils to the first four pins of port 2 of 8051 through the ULN2003A.
- 8051 doesn't provide enough current to drive the coils so we need to use a **current driver IC that is ULN2003A**.
- In ULN2003A, 7 pins are input pins and 7 pins are output pins, two pins are for Vcc (power supply) and Ground.
- Here we are using four input and four output pins. We can also use L293D IC in place of ULN2003A for current amplification.

Programmable Timer Interrupt

```
#include <reg52.h>
 #define Stepper_Port P2
/* Define Stepper Motor Port */ /* Function to provide delay of 1ms at 11.0592 MHz */
void delay(unsigned int count)
 {
 int i,j;
 for(i=0; i<count; i++)
for(j=0; j<112; j++);
 }
 int main(void)
 {
int i,period; period = 100; /* Set period in between two steps of Stepper Motor */ while (1) { /* Rotate Stepper Motor clockwise with Half
step sequence */
 for(i=0; i<12; i++)
 {
 Stepper_Port = 0x09; delay(period);
 Stepper_Port = 0x08; delay(period);
Stepper_Port = 0x0C; delay(period);
Stepper_Port = 0x04; delay(period);
 Stepper_Port = 0x06; delay(period);
 Stepper_Port = 0x02; delay(period);
 Stepper_Port = 0x03; delay(period);
Stepper_Port = 0x01; delay(period);
 }
 /* last one step to acquire initial position */
Stepper_Port = 0x09; delay(period);
delay(1000); /* Rotate Stepper Motor Anticlockwise with Full step sequence */
for(i=0; i<12; i++)
 {
Stepper_Port = 0x09;
delay(period);
 Stepper_Port = 0x03;
delay(period);
Stepper_Port = 0x06;
delay(period);
Stepper_Port = 0x0C;
delay(period);
}
Stepper_Port = 0x09;
delay(period);
delay(1000); }
 }
```

References

https://www.electronicwings.com/8051/stepper-motor-interfacing-with-8051

https://circuitdigest.com/microcontroller-projects/stepper-motor-interfacing-with-8051

Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, - The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition, Pearson Education,2011